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Title: MATERIAL FOR LOW FREQUENCY MAGNETIC SHIELD

Abstract:

The present invention provides a material for magnetic shield of which shield effect is high on alternating magnetic field, especially, alternating magnetic field of frequency lower than 5MHz. Besides, it is also flexible. Metal of which maximum permeability is 1,000 or higher, such as PC Permalloy, SUS 430 type stainless steel, etc., are cold-drawn to make a very fine wire of which diameter is 30µm. The fine wires are woven into a twill cloth.

TECHNICAL FIELD OF THE INVENTION

This invention relates to a magnetic shield material for low frequency. It is a cloth made of very fine metal wires of which maximum relative permeability is 1,000 or higher.

PROBLEM TO BE SOLVED

It is called that alternating magnetic field of low frequency may affect a human body. Therefore, the present invention provides a magnetic shield against magnetic field of low frequency, especially, 5MHz or lower. Besides, it is flexible to be able to make a magnetic shield uniform or apron.

EMBODIMENT OF THE INVENTION

A low frequency magnetic shield material according to the present invention is a cloth-like stuff made of very fine metal wires. It would be good that the diameter of the wire is 100 µm or shorter for a magnetic shield uniform, apron etc. to get flexibility.

The fine metal wire is made by a process of cold drawing as usual. It is made from a metal of which maximum relative permeability should be 1,000 or higher. This is because the shield effect is not enough if the maximum relative permeability is lower than 1,000.

The following table 1 shows the maximum relative permeability of embodiments according to the present invention. The metals are cold drawn to make fine wires of

which diameter are 30 μm. The wires are woven into twill clothes such as one string is made of ten wires, and the twill is woven by 1:4. The maximum relative permeability is measured by a DC magnetic characteristic examination according to the Japanese Industrial standard (JIS) C 2531.

Table 1

Item	Metal	Max. Relative Permeability
Embodiment 1	PC Permalloy	400,000
Embodiment 2	PD Permalloy	20,000
Embodiment 3	SUS 430 Stainless Steel	6,000
Embodiment 4	Pure Iron	6,000
Embodiment 5	PC Permalloy	100,000
Embodiment 6	PB Permalloy	30,000
Sample 1	Nickel	7
Sample 2	Copper	1

The above clothes of width 157 mm x length 150 mm are curled up to make a hollow cylindrical bodies for magnetic shield characteristic test which is done by an apparatus shown in Fig. 1. A power source 6 has an oscillator 3, an amplifier 4 and a current meter 5, and provides driving currents to a pair of ring type Helmholtz coils 1 and 2 that are magnetic field sources. The pair of the Helmholtz coils 1 and 2 make uniform magnetic field between them. The cylindrical body under test 7 is located between the Helmholtz coils 1 and 2, or the uniform magnetic field. A sensor coil 8 is inserted into the cavity of the cylindrical body under test 7. A voltage detector 9 detects the output voltage Ei of the sensor coil 8 to measure leak magnetic flux passing through the cylindrical body under test 7. The output voltage Eo of the sensor coil 8 is also measured when there is no cylindrical body under test 7. Then, shield effect S is calculated by the following equation 1.

$$S = 20 \text{ Log } (Eo / Ei) \text{ ------------ } (1)$$

The following table 2 shows the results of the shield effect S with varying the frequency of the oscillator 3. The table 2 says that the shield effects of the embodiments of the present invention do not go down against the low frequency alternating magnetic field. Especially, there is a large difference from the samples in the frequency lower than 5MHz. The low frequency magnetic shield according to the present invention adopt a twill cloth made of very fine metal wires of the diameter 30 μm so that it is flexible.

Table 2

Item	Shield Effect (dB)			
	50Hz	5kHz	5MHz	10MHz
Embodiment 1	47	28	20	13
Embodiment 2	25	8	7	5
Embodiment 3	20	6	5.5	4
Embodiment 4	19	5.5	5	3
Embodiment 5	37	21	18	12
Embodiment 6	28	10	9	6
Sample 1	0.003	0.004	4.5	5.1
Sample 2	0.001	0.002	5	5.3

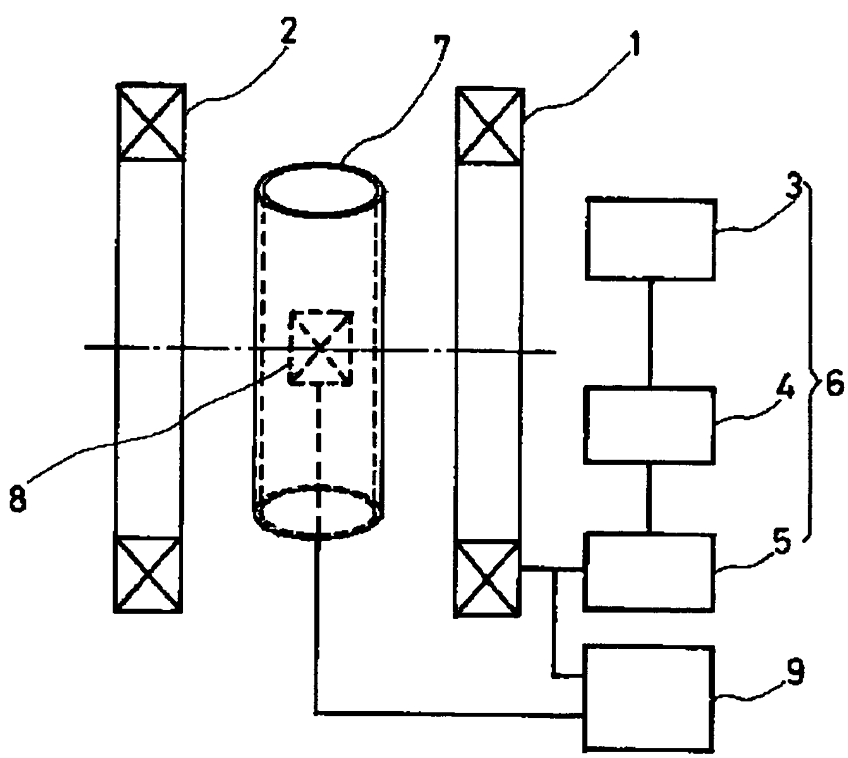

FIG. 1